

Amendments to the Specification:

[0093] In a one-In one variation on the first alternative embodiment, the reciprocating wand assembly 400 may be connected with a boom comprising twin boom tubes 412 as illustrated in FIG. 27. The cleaning solution is delivered to each of the wands 410 from one of the twin boom tubes 412 by a hose 414, as shown. The operation of the wand assembly 400 is substantially the same as described above. Another twin boom variation is illustrated in FIG. 28, wherein each of the wands 410 is pivotally connected to a transfer arm 416 that transfers the pivotal motion applied to the first wand by the motor 435 to the other two wands.

[0097] A third alternative embodiment is illustrated in FIGS. 19 and 20, wherein the tilt of the pivoting boom 245 is directly dependent on the vertical position of the moveable platform 240. Although this system does not offer the same degree of customizability for vehicles of differing profiles, it less it is less complicated than the preferred embodiment and potentially much less expensive to produce as well. In the third alternative embodiment, a follower arm 505 is keyed to the pivoting boom 245. The follower arm 505 is typically an elongated member that is vertically orientated along its length. The follower arm 505 is attached at an upper end to the pivoting boom 245. The follower arm 505 rides between two opposing guides surfaces 515 formed by framework 510 within the left leg 205 of the gantry structure 105. Near the top of the left leg 205 the wand assemblies 250 are preferably orientated parallel to the ground. Accordingly, the opposing guide surfaces 515 are vertically disposed and spaced from each other a distance only slightly greater than the width of the follower arm 505. At a predetermined vertical location below the top of the left leg 205, the two opposing surfaces 515 diverge from each other at an acute angle, wherein the opposing guide surfaces 515 viewed together have an inverted Y-shape.

[0110] As described above various types of high pressure nozzles are utilized in the various embodiments of the present invention, including zero degree nozzles, fast rotating turbo nozzles, slow rotating turbo nozzles, and oscillating nozzles. Zero degree nozzles are well known in the art and are commercially available from a variety of vendors. Typically, zero degree nozzles shoot a single jet of fluid from a fixed orifice, such that each they impact on such that the jet impacts a relatively small area on the surface of a vehicle when used in conjunction with a vehicle wash system. Accordingly, they are typically utilized with rotating wands that move the nozzles over the surface of the vehicle to obtain complete coverage of the associated surface, such as the rotating wand assemblies described concerning the first embodiment. Given the high integrity of the fluid jets that emanate from Zero degree nozzles, they typically have a maximum effective range of up to 80 inches.

[0111] As illustrated in FIG. 34, both the fast and slow rotating turbo nozzles comprise a rotating nozzle member 805 that has having an orifice 810 that rotates within thea body 815 of the nozzle causing thea fluid jet emanating therefrom to assume a spiral shape as illustrated in FIG. 16. This causes a single turbo nozzle to have a circular impact area, which makes obtaining complete coverage of the vehicle surfaces simpler. For instance, in certain circumstances, the use of fast rotating turbo nozzles 405 with the reciprocating wand assemblies 400 of the second alternative embodiment result results in better coverage of the vehicle surfaces and more effective cleaning of the surfaces than the zero degree nozzles used with the rotating wands of the first embodiment. Furthermore, by substituting fast rotating turbo nozzles for the zero degree nozzles

in the rotating wands of the first embodiment, multiple impacts of the stream with the automobile surfaces results ~~for in~~ improved cleaning performance. The versatility of the fast rotating turbo nozzle is also demonstrated by the second alternative embodiment where the use of reciprocating wands are eliminated, since turbo nozzles with spray patterns that overlap at least partially can effectively clean the entire top surface of a vehicle when combined with the movement of the gantry over the vehicle. It is also noted that the series of turbo nozzles located on either leg of the gantry effectively replace side wand assemblies utilizing zero degree nozzles without a reduction in cleaning effectiveness. Another advantage of turbo nozzles generally is there ability to operate effectively at lower pressures than the typical zero degree nozzle. Whereas, zero degree nozzles generally require pressures of around 900 psi or greater, typical turbo nozzles can operate at pressures of as low as 600 psi.

[0112] Fast rotating turbo nozzles, in which the nozzle orifice rotates at speeds ~~of round of~~ around 1600 to 2000 rpm, are commercially available in a variety of sizes from several vendors and have been utilized in various applications on vehicle wash systems. However, fast rotating turbo nozzles suffer from a drawback that has limited their application in certain vehicle wash system applications, namely, they have a limited effective range of 28" to 36 depending on the size of the fast rotating nozzle specified. At distances in excess of the effective range, the spiraling fluid jet loses its integrity and becomes a mist, which although increasing the coverage of the underlying surface, does not impart enough of an impact force on the vehicle to effectively dislodge dirt and debris. It can be appreciated ~~that~~ the total distance traveled by any portion of cleaning solution in a spiraling fluid jet as it spirals towards a vehicle's surface is much greater than the distance between the nozzle orifice and the surface to be cleaned. In other words, the length of an uncoiled spiraling jet would be much greater than the distance between the nozzle tip and the surface of the vehicle. It follows, therefore, that the aerodynamic drag incident on a spiraling fluid jet from mist and air would be significantly greater than on a comparable straight fluid jet (such as from a zero degree nozzle). This aerodynamic drag tends to dissipate some of the spiraling jets energy. Furthermore, the complex force vectors acting on the spiraling fluid jet as it leaves the nozzle and ~~travel travels~~ towards the vehicle surfaces tends to compromise the integrity of the spiraling jet contributing to its effective disintegration at much ~~shorter~~ shorter distances than a comparable straight fluid jet.

[0114] FIGS. 34-40 and FIG. 42 illustrate a slow rotating turbo nozzle. Furthermore, FIG. 41 illustrates a cross section of a fast rotating turbo nozzle for purposes of comparison. Unless otherwise indicated, the description ~~provided~~ herein generally applies to both fast and slow rotating turbo nozzles. Distinctions between the fast and slow turbo nozzles will be specifically indicated.

[0115] As shown in FIG. 34, A typical turbo nozzle comprises three basic components: ~~a nozzle~~ the nozzle body 815; an inlet cap 820 that is threadably received into the top of the body; and a ~~rotating~~ the rotating nozzle member 805 that is contained within the body. The hollow nozzle body 815 has a generally conical shape beginning with a threaded opening to receive the inlet cap 820 at a distal end. From the distal end, the walls of the body 815 taper until terminating at the proximal end in a ceramic seat 825. The ceramic seat 825 has a concave inside surface

configured to receive the orifice of the rotating nozzle member and a passage 830 therethrough to permit the fluid jet emanating from the orifice to exit the turbo nozzle.

[0117] The rotating nozzle member 805 is illustrated in isolation in FIGS. 35 and 36. The rotating nozzle member 805 typically comprises a brass tube 855 having a perforated support piece 860 spanning the interior of the tube proximate its distal end to provide support and additional strength thereto. The ~~distal~~proximal end of the tube is capped with a ceramic orifice 810 from which the spiraling jet of the turbo nozzle emanates. The ceramic orifice 810 has a generally conical shape that terminates in a rounded end. The rounded end is sized to nest in the concave portion of the ceramic seat 825 such that when under pressure the ceramic orifice 810 effectively seals the passage through the ceramic seat 825. The diameter of the ceramic orifice 810 ultimately controls the volumetric output of the nozzle.

[0118] The outside surface of the brass tube 855 is covered by one or more plastic shrouds 865, 870 and 875. In general, the plastic shrouds serve to protect the brass tube 855 as the nozzle member 805 is rotated within the nozzle body 815 at high speeds. Depending on the particular configuration of the turbo nozzle, a single unitary plastic shroud maybe utilized, although as illustrated, three separate and distinct shrouds 865, 870 and 875 are indicated. The upper shroud 865 serves to guide the nozzle member 805 around the nib 850, as best illustrated in FIGS. 34 and 38. The middle shroud 870, which is shown having a hexagonal outer surface, serves to guide the nozzle member 805 along the inside surface of the nozzle body 815 as best illustrated in FIG. 39. Because the middle shroud 370-shroud 870 is hexagonal, it will cause the orifice 810 to rotate in a more hexagonal pattern, thereby altering the characteristics of the fluid jet emanating therefrom. Furthermore, the hexagonal surface of the middle shroud 870 will not rotate as easily around the inside surface of the nozzle body 815, thereby increasing the rotational friction of the nozzle member 805, slowing its effective rate of rotation even further. As illustrated in FIG. 40, the hexagonal shroud 370 can be replaced with a circular shroud 870A in variations thereof.

[0123] In general, the effective range (approximately 45") of the oscillating nozzles is greater than that of the turbo nozzles; however, the range of faster small body oscillators is less than that of a slower large body oscillator. It is to be appreciated that the speed of oscillation is directly related to the velocity of the vortex created in the nozzle body and the distance that the vortex must travel to complete a revolution of the inside of the body 915. It follows that the speed of oscillation may be reduced by (1) increasing the size of the nozzle body whereby the vortex has a greater distance to travel to complete a revolution, or ~~the Accordingly and/or~~(2) using the same types of modifications to the inlet cap passageways 945 as described above for turbo nozzles to slow the velocity of the stream emanating from passageways 945.